IMPACT OF GENERAL AND SKILL BASED CIRCUIT TRAINING PROGRAM ON SELECTED BIOCHEMICAL PHYSIOLOGICAL VARIABLES AND SKILL ABILITIES OF SOCCER PLAYERS

SHORT SYNOPSIS

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Certificate

I hereby declare that the short synopsis titled **"Impact of General and Skill-Based Circuit Training Program on Selected Biochemical, Physiological Variables and Skill Abilities of Soccer Players"** is being submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in Physical Education under the Department of Exercise Physiology, Lakshmibai National Institute of Physical Education (LNIPE), Gwalior, during the academic year 2021–2022.

It is a bonafide record of original research work carried out under the supervision of Lt (Dr.) Gayatri Panday, and has not been submitted either in full or in part to any other university or institute for the award of any degree or diploma. It is further certified that the short synopsis is plagiarism-free, and the plagiarism report has been submitted along with this document.

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Abstract

The proposed study aims to evaluate the impact of general and skill-based circuit training programs on selected biochemical, physiological variables, and soccer skill abilities of male soccer players over a 56-day training period. The study follows a pre-test and post-test control group design involving three groups: a control group, an experimental group undergoing general circuit training, and a second experimental group receiving soccer-specific skill-based circuit training. Biochemical variables to be measured include total cholesterol, high-density lipoprotein cholesterol (HDLC), low-density lipoprotein cholesterol (LDLC), triglycerides, red blood cell count, haemoglobin level, and blood glucose. Physiological variables include systolic, diastolic, and mean arterial blood pressure, VO_2 max, and anaerobic power. Soccer-specific skill abilities passing, dribbling, and shooting—will be assessed to evaluate performance improvements. Prior to inferential analysis, data will be assessed for normality using the Shapiro-Wilk test to determine suitability for parametric statistical techniques. Statistical analysis will be conducted using SPSS (Statistical Package for the Social Sciences). Descriptive statistics, Analysis of Covariance (ANCOVA), and post-hoc tests (such as Least Significant Difference, LSD) will be applied to evaluate within-group and between-group differences. The study is expected to reveal significant improvements in the experimental groups compared to the control group, with distinct variations in outcomes between general and skill-based training interventions. The findings aim to provide valuable insights for designing scientifically structured, sport-specific training protocols to enhance soccer performance.

Keywords: General Circuit Training, Skill-Based Training, Biochemical Variables, Physiological Variables, Soccer Skill Performance

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1 INTRODUCTION

Soccer (Football), is one of the most popular and widely played sports in the world by children and adults, men and women with different levels of expertise (Arnason et al., 2004; Stølen et al., 2005; Tumilty, 1993). As regards team sports characterized by short sprinting, rapid acceleration or deceleration, turning, jumping, kicking, and tackling (Arnason et al., 2004; Wisløff et al., 1998). It is a complex sport, and performance depends on a myriad of factors such as physical fitness, psychological attributes, technical skills, and team tactics (Arnason et al., 2004; Stølen et al., 2005).

It is a sport demands high-level physical and technical abilities under match pressures such as limited space, time constraints, fatigue, and opponent challenges. Players must develop aerobic and anaerobic fitness, power, strength, speed, and agility to perform optimally (Dolci et al., 2020; Marín-Pagán et al., 2020; Silva et al., 2022). A 90-minute game typically involves covering 10 km with sprints every 90 seconds, each lasting 2–4 seconds (Inklaar, 1994; Kumar, 2021). The modern game has become faster and more intense (Arnason et al., 2004; Tumilty, 1993). Performance varies even among equally skilled players due to physical and mental factors (Sharma, 2003).

In developed countries, early scientific awareness of fitness, motor learning, and skill development helps children pursue high sports achievements. A footballer's performance largely depends on physical capabilities supported by other factors. There is a strong correlation between physical fitness and sports performance (M. Singh & Sharma, 2020). Key motor abilities such as speed, power, strength, endurance, agility, balance, and cardiorespiratory fitness are essential for football success (Belli et al., 2022). Physical fitness, combining health- and skill-related components, plays a critical role in shaping sports performance. Football, being a highly competitive sport, demands a high level of physical fitness for effective execution of technical and tactical skills (Kariyawasam et al., 2019).

Football has three major components. They are fitness, technique, and tactics. If a player is not fit his techniques will suffer, especially towards the end in a match. If a player’s technique is not nearly perfect working on tactics is waste of time. But if a player is fit enough, his vision, awareness, instinctive reactions, skill, confidence, and decision making are benefited. A fit players is less likely to be injured, and when injured, will recover quickly. It is known a fact that today’s game is more demanding than it has been. football is played at faster pace and this calls for sharper thinking, high standard of skill and application. It is essential that correct balance between basic

fitness and skill and techniques is maintained (Mal, 2004). As participation in soccer continues to grow and becomes increasingly competitive with ever increasing physical demands, baseline physical fitness of soccer players has become critical to success (Stølen et al., 2005). Forget the simplistic view, that players are born and not made, because even the greatest players in the world have worked hard to improve their skills. Many training methods have been developed to increase physical fitness among football players. However, these training methods vary according to the aim of training (Lee & Joo, 2020).

Circuit training

Among the various training methods, circuit training (CT) has gained popularity in recent years as an effective approach for improving overall body fitness while simultaneously enhancing or maintaining sports performance, particularly among young athlete (Lehnert et al., 2015; Monteiro et al., 2008; Santoso, 2022). Several studies have confirmed that Modern CT method is one of the most commonly used method in many sports including football (Tsegay et al., 2021). it is a popular effective methodology in fitness and wellness programs, as well as in sports, this training combines a number of different components of training, thus total fitness is emphasized, it is an effective organizational form of doing physical exercises for improving all physical fitness components because it allows the development of such as Muscle endurance (Belli et al., 2022) Muscle Strength (Zein et al., 2020) Agility (Tsegay et al., 2021) Power (L. Singh & Patir, 2021) Balance (Belli et al., 2022) Body composition (Taskin, 2009) Speed (Hassan, 2018; Tsegay et al., 2021) and Cardio-vascular–respiratory endurance adaptations in a time-efficient manner (Kumar, 2021; Marín-Pagán et al., 2014). The general circuit training consists of a number of different exercises, usually between 10 and 15 forms of exercise commonly called a post. At each post of the CT the individual must do about 15 repetitions in 40 seconds, while the intensity of resistance training should not exceed 60% of one maximum repetition, with short rest periods between exercises (Hartati et al., 2020; Romero-Arenas et al., 2013). this program, which included one exercise for each major muscle group for 2 cycles of between 12–15 reps per exercise at a moderate intensity only of approximately 50% repetition maximum (Tse et al., 2005).

Skill based circuit training

Circuit based skill training is designed to develop cardio respiratory endurance as well as flexibility, strength and muscular endurance in essential muscle group. It is an efficient training method in terms of gain made in short time. Skill Training is called "A learned ability to bring about the result with maximum certainty and efficiency". Circuit based skill training is an excellent way that simultaneously assemble strength and stamina. To meet the specific requirements of a sport a design a circuit that is sport-specific to being specific to the sport that the athlete is involved. Each skill is performed for a specified number of repetitions, timed in between intervals and long rest period. Circuit based skill efforts will enhance our overall body strength, including the strength and resiliency of muscles, tendons, ligaments, and density for bone structure also. In an exercise circuit, all the prescribed exercises are performed for a time duration allotted by the coach to improve a skill which is expected to be significant (Thangamani, 2022). Skill-based circuit training is more efficient to bring out desirable changes over agility and dribbling of women footballers (Dharmarajan et al., 2020).

The game specific circuit training is a modified version of circuit training. It is an adaptation of circuit to normal exercises performed in a gymnasium or exercise hall to a court or field. Here the exercises selected for the circuit are game oriented, that is the exercises prescribed in a circuit will be skills, techniques or even game specific movements that are frequently used in actual game situations. The arena for the game specific circuit training can be designed by the will of the coach or trainer, he/she can use the complete court or half of the field etc. The fundamental aim of this training is to improve the cardiovascular endurance, but while using skills, techniques or game-oriented movements the athlete can correct and sharpen skills for the game. Since the majority of the exercises are game oriented, the sportsperson can avoid boredom and could show more commitments towards the training. The effective use of the court or field can also help the players to use the playing area more efficiently during the competitions (Anand, 2020).

2 LITERATURE REVIEW

According to **Dharmarajan et al.'s (2020)**, the Skill based circuit training significantly improved agility and dribbling skills among female football players, as evidenced by a study involving 30 participants aged 18 to 25. The experimental group underwent training three times a week for twelve weeks, while the control group maintained their routine. Statistical analysis revealed significant enhancements in agility and dribbling performance, highlighting the effectiveness of this training method in enhancing physical fitness and skill performance parameters in women footballers, despite limitations such as diet and lifestyle.

Păun et al., (2022), conducted a study on the innovative teaching and training method using the circuit method resulted in significant improvements in motor skills, collaborative interactions, critical thinking, fast decision making, and strategic overview among the young football players. The research demonstrated that the circuit method, when applied to junior football players aged 10-12, was effective in achieving the specific goals of football training, particularly in improving technical-tactical skills and adapting players to performance demands after the COVID-19 pandemic. The study indicated that implementing the circuit method led to measurable progress in competitive matches, as evidenced by the analysis of shots on goal and scored goals, suggesting that this training approach can enhance the efficiency of young players in a competitive game setting.

N. Suresh, (2019) Investigated the effect of circuit-based skill training on female footballers' performance. Thirty players aged 18–25 from Nirmala College were divided into experimental and control groups. The experimental group trained three days a week for eight weeks. The findings revealed statistically significant improvements in both kicking and passing skills among participants in the experimental group, thereby confirming the efficacy of circuit-based training in enhancing football-specific motor skills.

In **Jeya Prakash, (2020)** research, the investigation aimed to explore the Impact of Circuit-based Skill Training on the skill performance of male footballers. Thirty male footballers were selected, aged between 18 to 25 years, and divided equally into two groups. Group-I underwent circuit training, while Group-II served as the control group. Training sessions occurred three days per week for eight weeks. The findings suggested significant enhancements in kicking and passing skills among male footballers due to the influence of circuit-based skill training.

(Wahdi, 2019) studied the effect of dribbling exercises using circuit training on U-15 footballers undergoing Coerver Coaching in Bandung. Fourteen players were purposively selected and tested using a slalom dribble test. The experimental group showed a significant improvement in dribbling, with a mean gain of 2.02 compared to 0.99 in the control group. The findings confirm that circuit training effectively enhances dribbling skills in young football players.

(K. M, 2017) investigated the isolated and combined effects of SAQ and circuit-based skill training on fitness and performance variables in male inter-collegiate football players. Eighty players were divided into four groups, including SAQ, circuit training, combined training, and a control group. The 12-week intervention (4 days/week) showed that the combined SAQ and circuit-based training group achieved the most significant improvements in speed, agility, coordination, and football-specific skills like dribbling, passing, and shooting.

(Thangamani, 2022) examined the effects of circuit-based skill training on dribbling and shooting among thirty male students from Maruthi College of Physical Education, Tamil Nadu. Participants were divided into an experimental and a control group (15 each). The experimental group trained for 12 weeks, 5 days a week, and was assessed using the Warner dribbling test and Mor Christian shooting test. ANCOVA results showed significant improvement in dribbling and shooting in the experimental group, while the control group showed no change.

Tsegay et al., (2021) examined the effects of high- and moderate-intensity football-specific circuit training on hematological variables among U-17 football players in Ethiopia. Sixty players were divided into high-intensity, moderate-intensity, and control groups, undergoing 16 weeks of training. Both training intensities significantly improved RBC, WBC, Hgb, and MCV, while reducing HCT and MCH. High-intensity training showed a greater increase in MCV, while moderate-intensity training led to a higher rise in RBC and greater reduction in MCH. ANCOVA and post-hoc tests revealed statistically significant differences across the groups. Blood samples were collected pre- and post-intervention from the cubital vein under standard procedures. The study concluded that different circuit training intensities produce varying effects on hematological parameters in adolescent footballers.

Paoli et al., (2013) examined the effects of high-intensity circuit training (HICT) on cardiovascular disease risk factors in overweight, middle-aged individuals, comparing it with low-intensity circuit training (LICT) and endurance training (ET). Fifty-eight participants were randomly assigned to HICT, LICT, or ET groups, training thrice weekly for 12 weeks. HICT led to significantly greater reductions in fat mass, diastolic blood pressure, total cholesterol, LDL-C, triglycerides, and ApoB, with higher increases in HDL-C. LICT showed the greatest drop in systolic blood pressure. All groups improved in body weight. Blood lipid profiles were most favorably altered by HICT. The study concluded that HICT is the most effective modality for improving cardiovascular health markers in this population.

Manna et al., (2010) conducted a study to examine the effect of training on selected physiological and biochemical variables among Indian soccer players across four age groups (U16, U19, U23, Senior). The 12-week training program was divided into Preparatory and Competitive phases, incorporating aerobic, anaerobic, and skill development sessions. Significant improvements were observed in VO2 max, anaerobic power, lean body mass, and HDL-C, along with reductions in

body fat, total cholesterol, LDL-C, and triglycerides. However, body mass and maximum heart rate showed no significant change. These findings aid in designing age-specific training and player selection strategies in Indian soccer.

According to **Kaviyarasan, (2024)** this study aimed to assess the effects of circuit training and ladder training on selected biochemical variables—Low-Density Lipoprotein (LDL) and High-Density Lipoprotein (HDL)—among university-level hockey players. Sixty players aged 18 to 25 were randomly divided into four groups: Circuit Training, Ladder Training, Combined Training, and Control. After 12 weeks of training, significant improvements were observed in all experimental groups compared to the control group. The combined training group showed the most notable changes in reducing LDL and increasing HDL levels. These findings confirm that both training methods are effective, and their combination yields the best results. Therefore, combined training is recommended to enhance the biochemical health of university hockey players.

(A. M et al., 2010) studied the effects of six weeks of concurrent and circuit training on aerobic and anaerobic power in adolescent male soccer players. Twenty-four players were divided into two groups: one performed resistance and endurance training separately, and the other followed a 10-station circuit. Both groups showed significant improvement in aerobic power, but no significant changes in anaerobic power. Circuit training was more effective in enhancing aerobic capacity among young soccer players.

(Novera, 2020) Novera (2020) investigated the impact of circuit training on dribbling ability in junior football players aged 12–14 at Kerinci 6 Public Middle School. Thirty participants followed a six-week program with three sessions per week. A pre- and post-test design using a manual t-test showed significant improvement ($t = 14.519 > t\text{-table} = 1.699$). The results confirmed that circuit training effectively enhanced dribbling skills in young footballers.

Farooque et al., (2023) examined the effects of 12 weeks of SAQ and circuit training on the skill ability of under-19 national-level male soccer players. Thirty players were divided into SAQ and circuit training groups (15 each), training one hour daily, four days a week. Significant improvements were observed in dribbling and shooting skills from pre- to post-test. The study concluded that both training methods effectively enhanced skill performance in soccer players.

Kamalesh, (2014) conducted a study to examine the combined effect of circuit training and resistance training on various physical, physiological, and performance variables of football players. The study included 60 randomly selected football players from Tirupathi Colleges in Andhra Pradesh, divided into four groups. Analysis of covariance (ANCOVA) was utilized to determine the effectiveness of different training methods. Results indicated significant improvements in physical variables like speed, endurance, agility, and flexibility, as well as physiological variables such as Vo2 max and resting

heart rate, and performance variables including dribbling, shooting, passing, and playing performance. The combined training group demonstrated superior improvement compared to circuit and resistance training alone. Post hoc analysis revealed nuanced differences between circuit and resistance training effects on various parameters, with combined training showing overall better results across multiple aspects of football performance.

3 DESCRIPTIONS OF BROAD AREA

This study lies at the intersection of sports training science, exercise physiology, and performance enhancement, particularly focusing on how different types of circuit training influence soccer performance.

1) Circuit Training as a Method of Conditioning

Circuit training is a systematic form of physical conditioning involving a sequence of exercises performed in rotation with minimal rest. It is designed to develop overall fitness, strength, endurance, and sport-specific skills. Circuit training is a form of conditioning that involves a series of exercises organized into multiple stations, typically ranging from six to fifteen, depending on the participants' fitness levels and training objectives. At each station, participants carry out specific exercises as part of a structured routine (Tsegay et al., 2021).

Two primary forms are:

General Circuit Training (GCT)

Focusing on fundamental strength, muscular endurance, aerobic capacity, and general physical preparedness. using body weight as a resistance is a popular fitness trend and an ideal exercise modality in terms of functionality and economy. Several body-weight exercises utilized in movements used in activities of daily living (e.g. squats, step-ups, etc.); these exercises provide functional fitness benefits (Clayton et al., 2019). GCT consists of a number of different exercises, usually between 10 and 15 forms of exercise commonly called a post. At each post of the CT the individual must do about 15 repetitions in 40 seconds, while the intensity of resistance training should not exceed 60% of one maximum repetition, with short rest periods between exercises (Hartati et al., 2020; Romero-Arenas et al., 2013). GCT program, which included one exercise for each major muscle group for 2 cycles of between 12–15 reps per exercise at a moderate intensity only of approximately 50% repetition maximum

(Tse et al., 2005) . The main purpose of (GCT) is to improve overall physical fitness by enhancing muscular strength, cardiovascular endurance, flexibility, and body composition (Wilmore et al., 1978).

Skill-Based Circuit Training (SCT)

A sport-specific circuit would be designed for sports persons looking to improve their performance in a particular sport. The game specific circuit training is a modified version of circuit training. The exercises selected for the circuit are game oriented, that is the exercises prescribed in a circuit will be skills, techniques or even game specific movements that are frequently used in actual game situations (Anand, 2020).

2) Biochemical & Physiological Variables in Sports Performance

Consistent physical activity and training lead to physiological and metabolic changes that impact various organs and systems, directly influencing athletic performance. For coaches, sports physicians, and athletes, tracking these adaptations is essential. Blood biomarkers are considered reliable indicators for assessing both short- and long-term training effects, as well as for monitoring overall health, detecting chronic stress, inflammation, fatigue, and helping prevent injuries (Díaz Martínez et al., 2022). Hemoglobin plays a vital role in transporting oxygen to muscles, which is especially crucial during aerobic activities when the demand for oxygen significantly increases. To perform optimally at high intensity, athletes need to maintain adequate hemoglobin levels. Since soccer heavily relies on aerobic capacity, maintaining normal hemoglobin levels is essential for peak performance. Additionally, serum urea and uric acid levels are often monitored to assess training-induced stress. Regular evaluation of these markers during soccer training can help determine the physiological load placed on athletes. Lipids also serve important biological roles, such as providing energy through triglycerides, storing fat in adipose tissue, and using cholesterol for building cell membranes and synthesizing steroid hormones. However, high cholesterol levels have been associated with an increased risk of coronary artery disease (CAD). Therefore, routine monitoring of these biochemical markers can offer insights into a player's health, metabolism, and cardiovascular condition. Both physiological and biochemical parameters are crucial for evaluating the effects of training and the overall health of soccer players. Tracking these variables throughout different stages of training, growth, and development can assist coaches in tailoring programs and making informed decisions regarding player selection. Despite their

importance, there is a notable lack of research in India focusing on the physiological and biochemical responses of soccer players in relation to training and development. (Manna et al., 2010).

3) Skill Abilities in Soccer

The performance defined as the overall ability and mastery of one individual in executing the skills involved in the game or it is the ability to execute the skills in an effective manner in all situations of the game. In the development of the game of football, skills have come into play an increasingly vital role in the quest for victory. Top level teams perfect the skills and change them into a highly refined and sophisticated art and are constantly searching for better training. There are number of skills involved in the game of football like dribbling, kicking, ball control, volleying, trapping, heading, short and long passing, receiving, and application to different situations.

4 OBJECTIVES OF THE STUDY

PROBLEM STATEMENT

The study intends to investigate the impact of General and Skill-Based Circuit Training programs on selected biochemical, physiological variables, and skill abilities of soccer players.

RESEARCH OBJECTIVES

- To assess the impact of General Circuit Training on selected biochemical variables (Total Cholesterol, HDL-C, LDL-C, Triglycerides, RBC, Hemoglobin, Blood Glucose) of intercollegiate male soccer players.
- To evaluate the effect of General Circuit Training on selected physiological variables (Systolic BP, Diastolic BP, Mean Arterial Pressure, VO_2 Max, Anaerobic Power).
- To determine the influence of General Circuit Training on soccer skill abilities (Passing, Dribbling, Shooting).
- To assess the effectiveness of Skill-based Circuit Training on the same set of biochemical variables (Total Cholesterol, HDL-C, LDL-C, Triglycerides, RBC, Hemoglobin, Blood Glucose).
- To evaluate the impact of Skill-Based Circuit Training on selected physiological variables (Systolic BP, Diastolic BP, Mean Arterial Pressure, VO_2 Max, Anaerobic Power).
- To determine the effectiveness of Skill-based Circuit Training on soccer-specific skills (Passing, Dribbling, Shooting).
- To compare the relative effectiveness of General and Skill-based Circuit Training programs on the selected biochemical, physiological, and skill variables.

RESEARCH METHODOLOGY

In this chapter, ❖ selection of subjects, ❖ selection of variables, ❖ criterion measures, ❖ administration of test, ❖ collection of data ❖ and statistical technique for analysis of data has been described.

Selection of Subjects

- By using random sampling technique, 60 Soccer players represented at least once the Inter-Collegiate level.
- Male Soccer players between the age group of 18 and 25 years
- Absence of any types of injuries which could potentially limit their performance that can affect their ability to undergo treatment program.

Selected participants will be equally divided into three groups with random assignment:

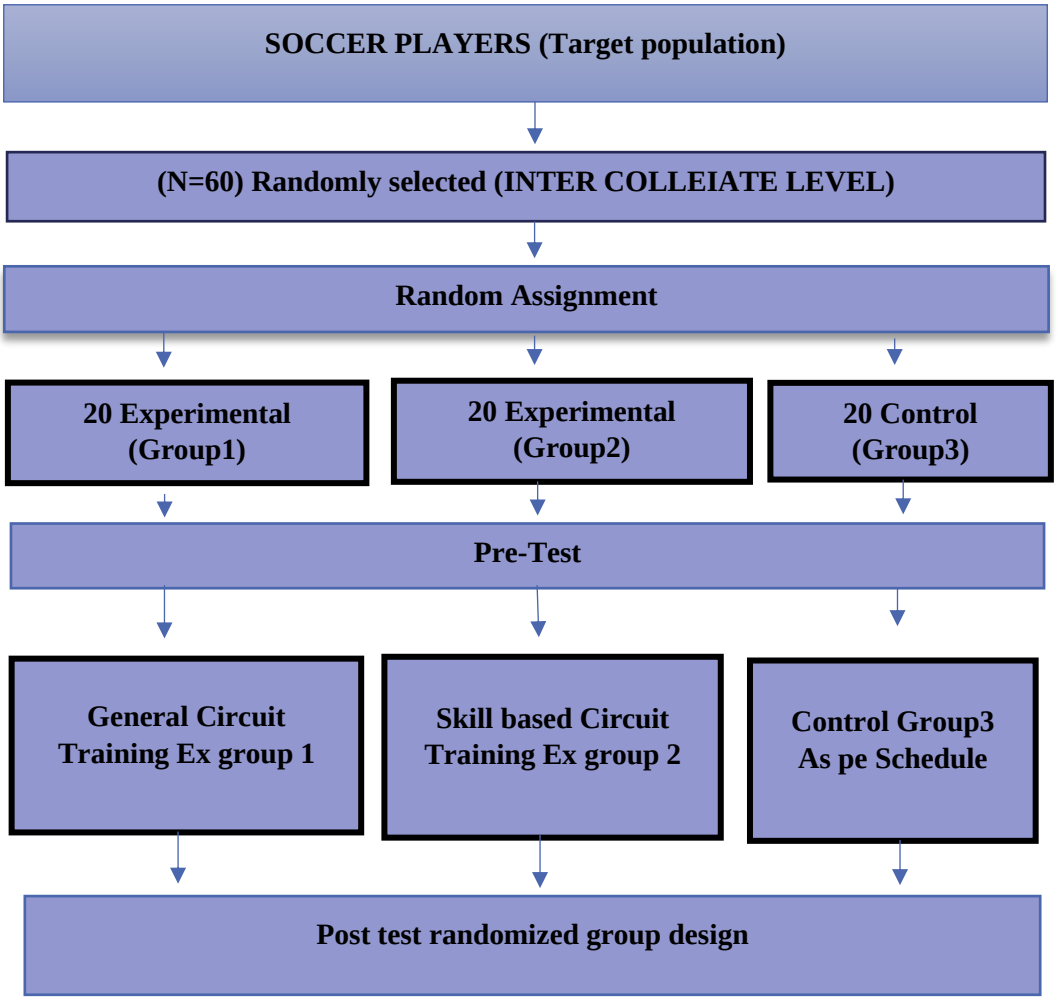
- Group A: General Circuit Training group
- Group B: Skill-based Circuit Training group
- Group C: Control group

Selection of variables and criteria measures

Following variables will be selected for the study:

S.NO	Variables	Test/Equipment used	Measuring unit
	Biochemical variables		
1	Total Cholesterol	Fully automated biochemistry analyzes (EM-200)	mg/dL.
2	LDHC		
3	HDLC		
4	Triglyceride		
5	Blood Glucose		
6	RBC count	Hemocue 201 plus monitor	g/dl
7	Hemoglobin		
	Physiological variables		
7	Systolic blood pressure	Automatic Sphygmomanometer	mm/hg
8	Diastolic blood pressure		
9	Mean arterial blood pressure		
10	Vo2 Max	12 min Cooper run/walk test	Meters
11	Anaerobic power	Running Anaerobic Sprint test (RAST)	In second
	Soccer Skills abilities		
13	Passing	Mor- Christian general soccer ability skill test Battery (Mor- D and Christian V.1979)	In points
14	Dribbling	Mor- Christian general soccer ability skill test Battery	In seconds (1/10th)
15	Shooting	Mor- Christian general soccer ability skill test Battery	In points

Administration of Test and Data collection
(Blue print of Sampling)


SOCCER PLAYERS (Target population)
(N=60) Randomly selected (INTER COLLEIATE LEVEL)
Random Assignment
20 Experimental (Group1)
20 Experimental (Group2)
20 Control (Group3)
Pre-Test
General Circuit Training Ex group 1
Skill based Circuit Training Ex group 2
Control Group3 As pe Schedule
Post test randomized group design

Administration of Training

- The investigator will personally supervise and ensures proper execution of the Circuit Training with the help of assistant.
- The General Circuit Training (GCT) & Skill based circuit training program will do 8 weeks by Experimental groups.
- The control group will do their activity as per their schedule.
- Total 8 stations they are in a GCT program. Must complete 2/3 Circuits every individual.
- The days of GCT & SCT will be 3 day per weeks means alternate days for eight weeks.
- The training session will be 60 minutes duration with additional thirty minutes.
- Subjects have to do 10 minutes warm up and warm-down exercises which include jogging, stretching, striding.
- Intensity of training will be increase every 2 weeks. In the form of time of doing exercise and rest periods.

Warming up Exercises for Experimental Groups	
Duration (10 mins)	**Name of the exercises**
4 mins	Brisk walking, jogging with loosening of the stiff muscles and slightly increasing the pace of the jogging.
3 mins	**Rotational exercises** ➢ Neck rotation in clockwise and anti-clock wise direction. ➢ Shoulder Rotation with both arms. ➢ Wrist Rotation. ➢ Trunk Rotation. ➢ Ankle Rotation clockwise & anti clockwise of both legs.
3 mins	**Stretching exercises** ➢ Arm stretching with up and down movement by holding both arms. ➢ Sideward bending of the upper body. ➢ Forward and backward bending of upper body. ➢ Alternate toe touch with both hands by stretching the legs sideward. ➢ Sideward and forward lounging. ➢ Stretching the legs sideways as far as possible and touch the ground by the elbows.

TRAINING SCHEDULE FOR EXPERIMENTAL GROUP 1 (CIRCUIT TRAINING) GENERAL CIRCUIT TRAINING PROGRAMME (1st-8th Weeks)								
Warming up	**Exercise name**	**Duration of Exercises**	**No of circuit per session**	**Rest interval b/n sets**	**Rest interval b/n circuit**	**Intensity**	**Frequency**	**Cooling down**
Week 1-3								
10 min	**Plyo Push-Up (U)**	30 sec	2	20 sec	2 min	Low	3 days	**10 min**
	Burpees (T)	30 sec	2	20 sec	2 min	Low	3 days	
	Plank (C)	30 sec	2	20 sec	2 min	Low	3 days	
	Squat jump (L)	30 sec	2	20 sec	2 min	Low	3 days	
	Triceps deps (U)	30 sec	2	20 sec	2 min	Low	3 days	
	Shuttle Run10m (T)	30 sec	2	20 sec	2 min	Low	3 days	
	Crunches (C)	30 sec	2	20 sec	2 min	Low	3 days	
	Walking lunges (L)	30 sec	2	20 sec	2 min	Low	3 days	
Week 4-6								
10 min	**Push-up & rotation (U)**	40 sec	2	30 sec	3 min	Moderate	3 days	**10 min**
	Jumping jack (T)	40 sec	2	30 sec	3 min	Moderate	3 days	
	Side Plank (C)	40 sec	2	30 sec	3 min	Moderate	3 days	
	Tuck Jump (L)	40 sec	2	30 sec	3 min	Moderate	3 days	
	Push up (U)	40 sec	2	30 sec	3 min	Moderate	3 days	
	Mountain climber (T)	40 sec	2	30 sec	3 min	Moderate	3 days	
	Sit-ups (C)	40 sec	2	30 sec	3 min	Moderate	3 days	
	High knees action (L)	40 sec	2	30 sec	3 min	Moderate	3 days	

Week 6-8								
10 min	**Floor Triceps extensions (U)**	50 sec	3	30 sec	3 min	High	3 days	**10 min**
	Step-up onto chair (T)	50 sec	3	30 sec	3 min	High	3 days	
	Leg raises (C)	50 sec	3	30 sec	3 min	High	3 days	
	Single leg hoping on spot (L)	50 sec	3	30 sec	3 min	High	3 days	
	Diamond push ups (U)	50 sec	3	30 sec	3 min	High	3 days	
	Bicycle kicks (C)	50 sec	3	30 sec	3 min	High	3 days	
	40 -m sprints (T)	50 sec	3	30 sec	3 min	High	3 days	
	Single leg kick backs (L)	50 sec	3	30 sec	3 min	High	3 days	

U: Upper Body
T: Total Body
C: Core
L: Lower Body
Sec: seconds
Min: minutes

For Experimental (Group 2)

Skill-based Circuit Training Drills

STATION 1:
Volleying:
- **Side foot volley (with left foot and right foot)**
- **Instep volley pass (with left foot and right foot)**

STATION 2:
Juggling:
- **Controlling and juggling with foot**
- **Controlling and juggling with Thigh**
- **Controlling and juggling with Head on the spot, while moving.**

- **STATION 3:**

Passing:
- **Wall pass with bench (Alternative passing and receiving)**

STATION 4:
Trapping:
- **Foot trap**
- **Thigh trap**
- **Chest trap**
- **Head trap**

STATION 5:
Dribbling:
- **Slalom dribbling past six markers 2.5 m apart**
- **Slalom dribbling past 10 poles (3 m apart)**
- **Figure 8 dribbling**

STATION 6:
Heading:
- **Two partners stand 5 m apart**
- **One partner throws high balls which the other has to head back while jumping during dynamic and static position (Jumping using both legs)**

STATION 7:
Running with the ball:
- **20 meters medium pace running with ball**
- **10 m sprint with ball and back**

STATION 8:
Shooting:
- **Shooting Infront of goal post with inside kick (dynamic position) no. of shooting is 2.**
- **Shooting Infront of goal post with instep kick (dynamic position) no. of shooting is 2.**

STATION 9:
1v1 Dribbling & Defending
- **One player dribble, the other defends within a confined space**

STATION 10:
Long Passing & First Touch
- **Players pass over 20–30 meters, focusing on accuracy & first touch**

STATION 11:
One-Touch Passing & Movement (I vs I passing)
- **Two players pass using one touch while constantly moving.**

STATION 12:
Crossing & Finishing
- **One player crosses the ball, the other attempts to finish.**

Skill-based Circuit Training Programme for 1st to 8th weeks
CIRCUIT TRAINING WITH BALL (SOCCER)

Sl.No.	Exercise	Repetition				Sets
		1-2 week	3-4 week	5-6 week	7-8 week	
1	Side foot volley and Instep volley pass	4-6	4-6	6-8	6-8	3
2	Controlling and juggling with foot, thigh, and head	4-6	4-6	6-8	6-8	3
3	Passing (Wall Pass with Bench)	4-6	4-6	6-8	6-8	3
4	Trapping with thigh, foot, chest, head	4-6	4-6	6-8	6-8	3
5	Figure 8 Dribbling and Slalom dribbling	4-6	4-6	6-8	6-8	3
6	Heading with pair	4-6	4-6	6-8	6-8	3
7	20 meters medium pace running with ball	4-6	4-6	6-8	6-8	3
8	Shooting Infront of goal post with inside and instep kick	4-6	4-6	6-8	6-8	3
9	1v1 Dribbling & Defending	4-6	4-6	6-8	6-8	3
10	Long Passing & First Touch	4-6	4-6	6-8	6-8	3
11	One-Touch Passing & Movement (I vs I passing)	4-6	4-6	6-8	6-8	3
12	Crossing & Finishing	4-6	4-6	6-8	6-8	3

- The Circuit-based Skill Training group performed twelve drills. Such as the Volley pass, juggling, passing (Wall Pass with Bench), Trapping, Zig zag Dribbling, Heading, running with ball, Shooting Infront of goal post1v1 Dribbling & Defending, Long Passing & First Touch, One-Touch Passing & Movement (I vs I passing) & Crossing & Finishing. The Circuit based skill training load for first and second weeks will be 4-6 repetitions of each exercise for 3 sets, third and fourth weeks will be 6-8 repetitions of each exercise for 3 sets. 5th and 6th weeks will be 6-8 repetitions of each exercise for 3 sets. 7th and 8th weeks will be 6-8 repetitions of each exercise for 3 sets. The rest in between the station will be 30 seconds. Circuit based skill training load will be raised by increased repetitions of 4-6 and 6-8 respectively.

PERIODIZATION & LOAD MANAGEMENT

Intensity of Skill-based Circuit Training program

Weeks	Duration of Exercise (in second)	Intensity (Pulse rate)	Number of Circuits	Repetition	Recovery time between each Exercise (in second)	Recovery time between Circuit (in minutes)	Frequency per week
i-ii	60 sec	75–95% HRmax	2	4-6	30	5	3 days
iii-iv	60 sec	75–95% HRmax	3	4-6	30	5	3 days
v-vi	80 sec	75–95% HRmax	3-4	6-8	40	5	3 days
vii-viii	80 sec	75–95% HRmax	4	6-8	40	5	3 days

Collection of Data

- The selected 60 subjects will be further divided into three groups of twenty subjects each. The first group will undergo General Circuit Training. The second group will undergo Skill-based Circuit Training. The third group will not go any types of training program and shall be the Controlled group of the study.
- Using the pretest post-test randomized group design, data will be collected before the training schedule and after the completion of training schedule i.e., after 8 weeks on the selected variables. Pre-test will be conducted 24 hours before the beginning of the experimentation and post-test will be conducted 24 hours after the completion of the experiments for all the subjects.
- While measuring Physiological variables and Skills proper testing procedure will be explained and demonstrated to the subjects first before final testing.
- All the Biochemical variables will be tested in specialized pathology lab.
- All the related data will be collected with the standard tests and reliable instruments.

Statistical Technique

- Descriptive statistics such as mean, standard error of mean, standard deviation, skewness, and kurtosis will used to describe important characteristic of data.
- For Analysis of Covariance (ANCOVA) to determine if there will be any significant difference among the treatment means of each variable.
- When analysis of covariance show significant differences between treatment means, Scheffe's post hoc test will be applied to test the significance of difference between the paired adjusted means at 0.05 level of confidence.
- All the statistical tests will be calculated using the statistical package for the social science (SPSS) for windows (Version 26). The level of statistical significance was set at $p < 0.05$.

5 EXPECTED OUTCOMES

The expected outcome of the study is that both General and Skill-Based Circuit Training programs will lead to significant improvements in the biochemical, physiological, and skill variables of intercollegiate male soccer players. Biochemical parameters such as total cholesterol, LDL-C, triglycerides, and blood glucose are anticipated to decrease, while HDL-C, red blood cell count, and hemoglobin levels are expected to increase, indicating enhanced metabolic health and oxygen-carrying capacity. Physiologically, improvements are expected in VO_2 max and anaerobic power, along with reductions or stabilization in systolic, diastolic, and mean arterial blood pressure, reflecting better cardiovascular efficiency and endurance. In terms of soccer-specific skills, players undergoing Skill-Based Circuit Training are expected to show greater improvements in passing, dribbling, and shooting abilities compared to those in the General Circuit Training group. Overall, while both training methods are likely to produce positive effects, Skill-Based Circuit Training is expected to be more effective in enhancing sport-specific performance along with contributing to general physical and biochemical fitness.

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